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DRIFT CASKS IN THE ARCTIC OCEAN.

BY HENRY G. BRYANT.

(Read April 3, 1902.)

Among the many notable sessions of this venerable Society, perhaps none in recent years have been more interesting than the "Nansen" meeting held on the afternoon of October 29, 1897. It was one of the last occasions on which our late President, Frederick Fraley, occupied the chair. The occasion was noteworthy, not only by reason of the paper on "Some of the Scientific Results of the Fram Expedition," read by the distinguished Norwegian explorer, but also because of the supplementary discussion which gave opportunity for Rear Admiral George W. Melville and other competent authorities to give expression to their views on the importance of Arctic research and the best methods of prosecuting it in the future.

In the course of his discourse on "The Drift of the Jeannette," Admiral Melville—after recommending that future attempts to explore the unknown area should start from the Bering Sea side—called attention to the fact that much valuable data relating to circumpolar currents could be obtained by setting adrift in the waters north of Bering Strait specially constructed casks containing the requisite records. A certain percentage of these floating messengers might fairly be expected to survive the perils of the Arctic pack and eventually be looked for in waters adjacent to Franz Joseph Land, Spitzbergen or Greenland. In this connection he remarked: "I do believe, however, from the information we have gained from the drift of the Jeannette and the Fram, that vessels of any kind, such as casks or driftwood, will come out by way of Spitzbergen—though not necessarily across the Pole. The only reason for sending men in ships is, that they may be observers to make a daily record of events. . . . But for this, I say, a hundred casks, properly numbered, made after the manner of a beer keg of twenty gallons capacity, properly hooped, and the ends extended out to complete a parabolic spindle, would demonstrate the drift."¹

This idea of studying ocean currents from data obtained from "bottle messages" is not entirely new, and has, in fact, been employed by the Hydrographic Office of the U. S. Navy and by

¹ "The Drift of the Jeannette," PROC. AM. PHIL. SOC., Vol. xxxvi, No. 156.

other agencies for some years past. But in such cases the messages have been enclosed in an ordinary bottle and have been distributed along the ordinary routes of ocean travel. But the idea of investigating circumpolar currents by means of specially constructed drift casks originated, I believe, with Admiral Melville, and the project possesses certain features which will commend it to that large body of students who are interested in the problems of oceanography. On another occasion I outlined some of the preliminaries of this experiment, and in this connection I venture to quote from that statement of the subject: ¹

“This proposed method of studying Arctic currents without endangering human life having been brought to the notice of the Geographical Society of Philadelphia, that body determined to undertake the project. In view of the exigencies of a long voyage on the floe ice, special attention was given in the construction of the casks to shape and strength of materials. Thus, to more readily escape crushing by the ice, as intimated above, their shape conformed to that of a parabolic spindle, while they were made of heavy oak staves one and one-quarter inches thick, encompassed by iron hoops three sixteenths of an inch thick and two inches wide. A coating of black ‘half stuff’ (pitch and resin mixed) was then applied. In addition to the preservative qualities of this coating, the thickness of the wood and metal used is believed to be sufficient to resist the attrition of the ice and the effects of corrosion during the long drift. The staves, so tapered as to form the spindle, were covered on the ends by light galvanized cast-iron caps, held in place by an iron rod five-eighths of an inch in diameter, extending the length of the cask and secured by conical nuts at each end. As above stated, a heavy coating of black water-proofing material was applied to the casks to guard against corrosion and decay. From the color used they will be more easily seen, and will also the more readily sink—under the action of the summer sun—into the body of the ice and be preserved from destruction by crushing. The number of each cask was etched into the wood, as well as painted on the outside. In accordance with the instructions of the originator of the plan, the vessels must be placed on the heavy floe ice. If set adrift in open water they would be too much at the mercy of winds and waves, whereas by being deposited on heavy ice, which

¹ “Drift Casks to Determine Arctic Currents,” by Henry G. Bryant, *Verhandlungen des Siebenten Internationalen Geographen-Kongresses*, Berlin, 1899, Zweiter Theil, Seite 663.

is more affected by under currents, they will probably be carried on a more correct drift. A reinforced bung-hole with bung was provided, and through this the message bottle was inserted. . . . This latter consisted of a narrow cylindrical tube made of flint glass, and technically known as an 'ignition tube,' accompanying which were suitable corks and sealing wax. As an additional precaution, these tubes were in turn enclosed in cases made of maple wood provided with screw tops.

"The message paper enclosed in this way was printed on linoleum paper by a permanent blue-print process, which renders it practically impervious to salt water. The enclosed message was printed in the English, Norwegian, German and French languages, and embodied the following particulars:

"(a) Space for name of vessel and master assisting in distribution, date, number of cask, and latitude and longitude of point where it was set adrift.

"(b) Directions as to filling in record and sealing up tube.

"(c) Blank space for insertion of name of finder, date and locality where cask was picked up.

"(d) Clause requesting finder to forward message paper to the nearest United States Consul at his home port, or to send it direct to the Geographical Society of Philadelphia.

"Accompanying each consignment of casks was a set of printed instructions to masters of vessels engaged in their distribution."

In the important and hazardous work of distributing the fifty casks provided for the experiment, the promoters of the enterprise have received the assistance of the U. S. Revenue Cutter Bear, which makes yearly trips to Point Barrow, Alaska, in the interests of the American whalemén. We have also profited by the coöperation of the Pacific Steam Whaling Co. and of Messrs. Liebes & Co., of San Francisco, both of whose vessels have assisted in placing the casks adrift in the far North. The reports of the accomplishment of this preliminary work have come in rather slowly owing to the length of the whaling voyages and other causes. Thus the first consignment of casks was shipped from San Francisco as early as March, 1899, and the others as soon after as opportunity offered; and yet, of the thirty-five casks whose distribution has thus far been reported, intelligence of the last distribution arrived here no later than December 11 of last year.

Thus only within the last few months has it been possible to report definitely in regard to the launching of the greater number

of the casks, and I have, therefore, availed myself of the present opportunity to present some details relating to the present status of the experiment. The directions to masters of vessels having in charge the distribution embodied the main ideas of the originator of the plan and recommended "that special efforts be made to carry a number of casks north of Bering Strait and thence to the westward, where a number of them should be set adrift at or near Herald Island. Then proceeding northward along the eastern edge of the ice pack until the highest safe latitude is obtained—say lat. 75° N., long. 170° W. from Greenwich. . . . At this point final sets of casks are to be set adrift to demonstrate, if possible, the currents to the eastward or northward and eastward, if any there prevail." In examining the reports sent in, I find that these instructions have been carried out in a praiseworthy manner. Thus I find, by plotting the positions indicated, that on August 19 and 21, 1901, the U. S. Revenue Cutter *Bear*, under Capt. Francis Tuttle, placed fifteen casks adrift at three different points on the floe ice north and northeast of Herald Island, making a northing in one instance of $72^{\circ} 18''$ near the 175^{th} meridian of west longitude.

In September, 1899, Capt. D. T. Tilton, of the S. S. *Alexander*, belonging to Messrs. Liebes, placed four casks adrift south and east of Herald Island, and in the same month Capt. Sherman, of the Pacific Steam Whaling Co.'s steamer *Thrasher*, discharged one cask W. N. W. of Point Barrow, while in September of last year (1901) the same company's vessel, the *Narwhal*, succeeded in launching three casks in three different locations well north and west of Herald Island. The highest northing yet reported as a delivery of the casks was attained by the vessel just mentioned on September 7, 1901, when 73° N. lat. was reached.

Thus we find that twenty-two casks have been successfully launched at different periods on the great ice pack north and northeast of Herald Island.

With a view of testing the probable existence of a northeastern or North American drift through the Parry Archipelago, and along the route followed by McClure fifty years ago in accomplishing the Northwest Passage, the whaling captains were requested to distribute some casks in the region of Banks Land, near the western approach to the Northwest Passage route. This plan coincided with the movements of the whaling fleet, the members of which frequently extend their voyages for considerable distances east of their winter

rendezvous, Herschel Island. Hence we find that some nine casks were set adrift off Banks Land in 1899 and 1900 by the steam whalers Alexander, Thrasher, Narwhal and Beluga. It seems to be altogether reasonable to assume that quite a large percentage of the water contributed to this part of the Arctic Ocean by the Mackenzie River should find its outlet by means of the devious channels which extend eastward among the islands of the American Archipelago ; but just which route the drift casks will take, or how long it will take them to reach the whaling grounds in Lancaster Sound, it is idle to conjecture. Should any number of the casks be recovered on the Atlantic side, however, the time occupied by them on the journey between the known termini can be ascertained with some accuracy, and the resulting data should throw some light on the speed of the current in question. From the representatives of this miniature flotilla which were cast adrift in the waters north of Bering Strait, we may look for more definite results.

It has been known for years that no appreciable amount of water from the Polar Ocean escaped through the narrow, shallow outlet of Bering Strait, while the knowledge gained from the drift of the Jeannette and Fram point to the existence of a well-defined drift across the circumpolar area to the shores of Franz Joseph Land, Spitzbergen and East Greenland. The presence of quantities of Siberian driftwood in the localities named can be explained by no other intelligent hypothesis, while it is well known that Dr. Nansen based the theory of his voyage primarily on the finding of the Jeannette relics on the west coast of Greenland, three years after the crushing of that vessel in the sea northeast of the New Siberian Islands. Prince Krapotkin, the distinguished Russian writer, gives due importance to the Jeannette's voyage as bearing on the solution of this problem, and commends Nansen for "embodying the drift of the Jeannette and the East Greenland ice drift in one mighty current. A formidable ice current, almost as mighty and of the same length as the Gulf Stream, a current having the same dominating influence in the life of our globe, has thus been proved to exist."¹ Those who are interested in this experiment indulge in the hope that these casks, which have been consigned to the sea ice near the locality where the Jeannette began her drift, will pursue their voyage across the Polar basin impelled by the same elemental forces which carried the Jeannette so far on her journey,

¹ "Recent Science," *Nineteenth Century*, February, 1897, p. 259.

and which subsequently swept the brave little Fram across a great portion of the unknown area.

From the nature of the case, it is difficult to prophesy the time that will be required to complete the drift.

The Jeannette was put into the ice in latitude $71^{\circ} 35'$ N. and longitude 175° W. and consumed twenty-two months in making her zigzag drift of 1300 miles. The provision list signed by Lieutenant DeLong, and the other articles believed to belong to the Jeannette, were three years in traversing the distance from the place where that vessel was crushed in latitude $77^{\circ} 15'$ N., longitude 155° E., to the point where they were picked up by the Eskimo, off Julianhaab, in South Greenland, a distance of 2900 miles.¹

Assuming that the resultant of the drift of these casks will be the same as that of the Jeannette before she sank, and assuming that their subsequent drift will be at a rate of speed corresponding to that of the relics—that is, about 2.6 miles per day of twenty-four hours—we find that a period of about five years will be required to bring them to the same locality; but it is only fair to assume that a certain percentage of the casks which are carried in this great current—estimated to be 300 miles in width—will find their way to the shores of Franz Joseph Land, Spitzbergen or Nova Zembla, in which event the chances are quite good of their being recovered at an earlier date by Norwegian walrus hunters or fishermen.

The controlling influence of winds in their relation to the recognized and well-defined ocean currents is a fact accepted by all meteorologists at the present day. It is said currents are set in motion by this agency which attain a speed of from three to four miles per hour. If such is the case where the ordinary ocean surfaces are concerned, how much more potent must the impelling force of the winds be in conditions where countless ice surfaces are presented to its action. In reading of the drift of the Jeannette, nothing is more striking than the rapid progress the imprisoned ship made in the summer months as a result of the influence of the continuous southeast winds which prevailed. Admiral Melville alludes to the effect of innumerable hummocks of ice, "like millions of sails set to catch the breeze," and states that after each of these disturbances had subsided a setback drift to the southeast set in.² The experiences of the Fram party appear to have been quite similar; and these facts would seem to point to some uniform and

¹ *The Farthest North*, Dr. Fridtjof Nansen, Vol. i, p. 19.

² "The Drift of the Jeannette," *Id.*

consistent set of conditions which may be explicable from a meteorological standpoint. The published weather charts show that there is an area of low barometric pressure where a cyclonic disturbance takes place whose centre in summer time is well north of Bering Strait, and which in yielding to seasonal changes drops down at the approach of winter to a region south of Bering Strait.

Thus in the summer months this centre of disturbance would be north of the position occupied by the Jeannette, and winds in following their accepted course from west to east would naturally be drawn in and approach the cyclonic area from the southeast, causing the continuous gales referred to by Admiral Melville.

Meteorologists also refer to the existence of a centre of cyclonic disturbance between the 70th and 80th parallels of north latitude, which, following the general law, progresses with the seasons on a more or less uniform path from west to east around the Polar basin. The presence of this moving centre of attraction (if it is accepted as an existent factor in circumpolar meteorology) must exert a controlling influence on the winds of this region, and it follows as a logical sequence that the direction of the ocean currents must be regulated by the same phenomena. Without claiming any special knowledge of this branch of the subject, it occurs to me that in this connection we may find an explanation of the existence of more or less constant winds at certain times of the year in the region referred to, and in these phenomena may lie the interpretation of the reality and constancy of the great Polar current.

With the generous coöperation of the various agencies mentioned, the drift-cask experiment has been successfully inaugurated. It is our intention to bespeak the aid of the U. S. Consuls in northern Europe likely to come in contact with seafaring people who may visit the northern waters where these casks may eventually put in an appearance. It is hoped that such publicity will be given to the project, that when the time arrives for these inanimate messengers to appear in waters frequented by men, a certain percentage of them may be recovered and reported upon.

We look forward with keen interest to the outcome of the present campaign of the gallant Peary, and to the efforts of the superbly equipped Baldwin-Ziegler expedition in its attack on the Pole.

To the Norwegian expedition under Sverdrup and the Russian one under Baron Toll, we also wish a full measure of success. And we trust all these explorers will return with important contributions to our knowledge of the far North.

Should the prize of the centuries be denied to these intrepid voyagers, however, it may be that some devoted enthusiast will be moved to attempt to explore the unknown area in an expedition planned on the lines of the Fram voyage, which after all promises the greatest chance of success.

In such an event it is hoped that the data secured as a result of this drift-cask experiment may be found to be a contribution of some value to the hydrography of the Arctic regions.

BLINDNESS FROM CONGENITAL MALFORMATION OF THE SKULL.

(Plate XX.)

BY CHARLES A. OLIVER, A.M., M.D.

(*Read April 5, 1902.*)

Congenital malformations of the skull assert their evil effects upon the integrity of the tissues of the visual apparatus and its consequent functioning in definite ways. Should the disturbing factors be set into activity during intrauterine existence, while the cranial bones are passing through their primary stages of development, the direct effects of such disturbance will be so great that not only will organic changes appear in the ocular structures, but coarse associated faults will manifest themselves in the related and contiguous tissues.

The posterior portion of the cranium is proportionally the largest during the early stages of development of the skull, the parietal regions beginning to enlarge at about the eighth week of intrauterine life, followed soon afterward by the frontal and the occipital regions.

The newly born cranium is relatively very large in comparison with the rest of the body. In contrast with the facial portion it exhibits a predominance of the cerebral part in proportion of seven to one. The six membranous fontanelles and the fibrous septa between the adjacent osseous structures continue intracranially with the dura mater and extend extracranially to form the pericranium, giving rise to sacs in which bony plates without diploë are situated. At this period of life there are cartilaginous areas scattered through the occipital bone, while the presphenoid portion of the sphenoid